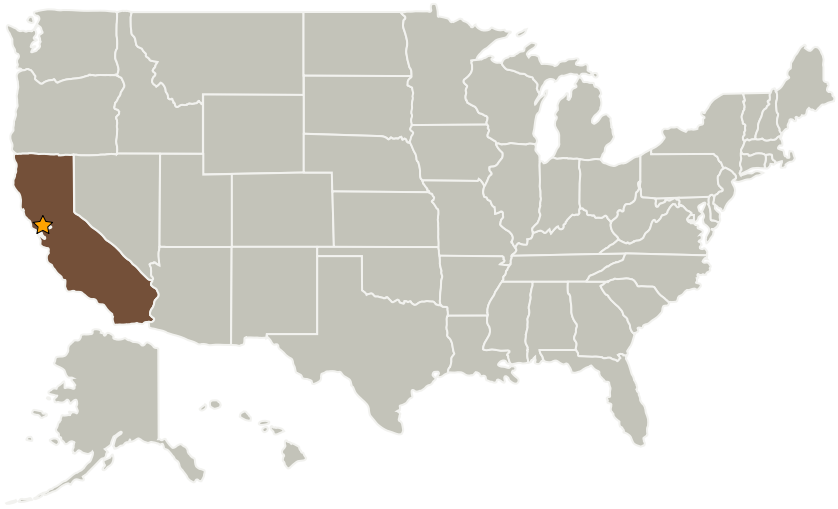
# Trajectory Design to Benefit Trajectory-Based Surface Operations, Phase I

Completed Technology Project (2009 - 2009)

## Project Introduction

Trajectory-based operations constitute a key mechanism considered by the Joint Planning and Development Office (JPDO) for managing traffic in high-density or high-complexity airspace in the Next-Generation Air Transportation System (NextGen). With this concept applied to surface operations at major airports, NASA's NextGen-Airportal Project is exploring the use of surface 4-dimensional (4D) trajectories, which use required times of arrival (RTAs) at selected locations along the route. Observing these RTAs as constraints along the taxi route, the flight still has many degrees of freedom in adjusting its state profiles (i.e., position, velocity, etc. as functions of time) to achieve the timing constraints. This research will investigate whether and how these degrees of freedom in trajectory control may be used to achieve desirable behaviors for the taxi operations. Previous research has applied the trajectory control freedom to assure passenger comfort by keeping the accelerations and decelerations within pre-specified limits, and yet there is still untapped flexibility in designing the trajectories. The proposed research will explore this trajectory design problem to achieve additional desirable behaviors, beginning with the consideration of fuel burn, emissions, and noise. A flight-deck automation experimental prototype will provide the platform for simulating the designs. The findings will benefit future designs of flight-deck automation systems, as well as tower automation systems which rely on accurate understanding of the flight deck's operational behaviors to plan efficient and safe operations for the entire surface traffic.

## Primary U.S. Work Locations and Key Partners

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## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Ames Research Center (ARC)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| ★Ames Research Center(ARC) | Lead Organization | NASA Center | Moffett Field, California |
| Optimal Synthesis, Inc. | Supporting Organization | Industry<br>Small Disadvantaged Business (SDB) | Los Altos, California |

| Primary U.S. Work Locations |
|---|
| California |

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX16 Air Traffic Management and Range Tracking Systems
  - TX16.3 Traffic Management Concepts